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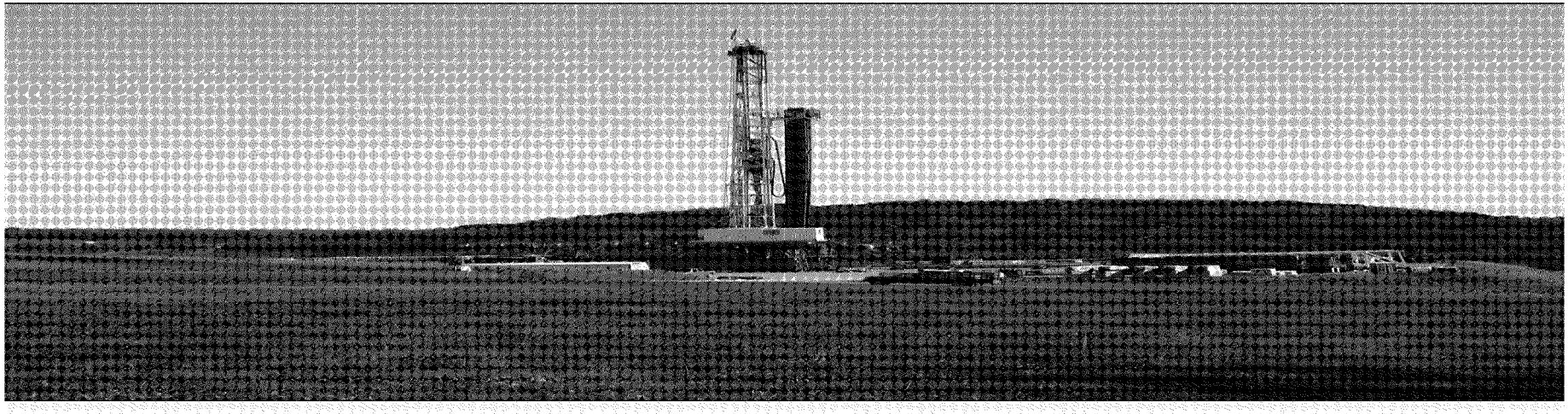
Hydraulic Fracturing: Separating Realities from Myths



Tarek Saba, Ph.D. and Farrukh Mohsen, Ph.D., P.E.

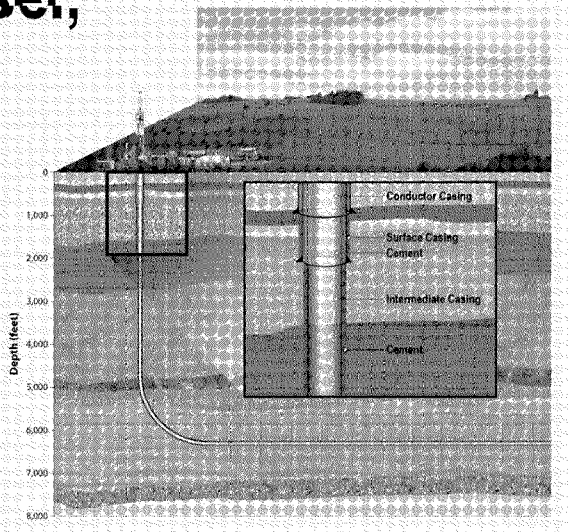
March 22, 2012

Salt Lake City

41st Annual Convention on Environmental Law, ABA

Today's Discussion

- Definitions and Recent Trends
- Litigation Trends: Impacts to residential water wells by Natural gas, metals, diesel, glycols
- Regulatory Trends: Diesel, CERCLA
- Research Trends
- Hydraulic Fracturing: Deep injection and Earthquakes

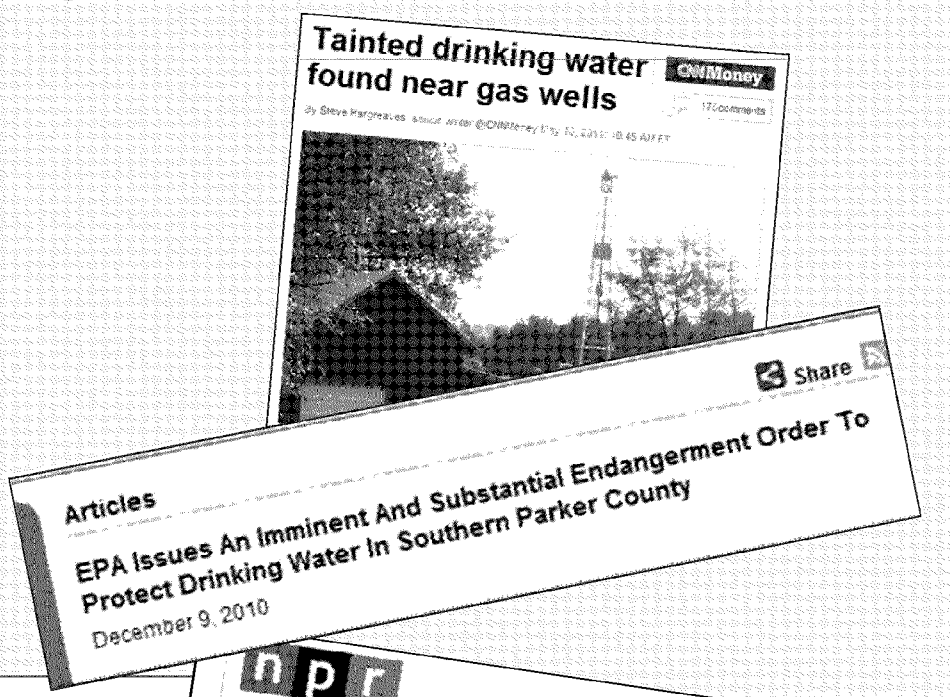


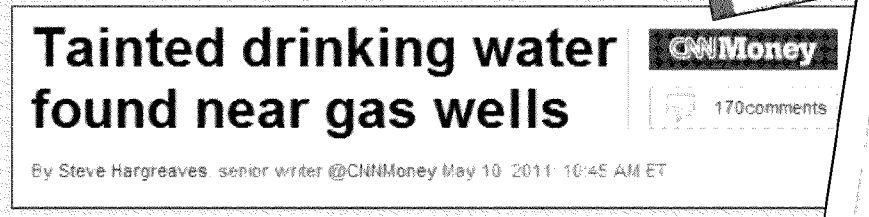
Definitions and Recent Litigation Trends

- **What do you mean when you say "hydraulic fracturing" ?**
  - Bridging the language barrier
- **A shift in litigation focus**
  - From methane in groundwater to other chemicals
- **Issues at the center of litigation**
  - Baseline conditions
  - Chemicals from sources not related to fracturing
- **Separating realities from myths**

Natural Gas In Residential Water Wells— Is it Related to Fracturing?

- Types of natural gas
  - Microbial and thermogenic
- Media says "It is from Fracturing"
- Some university studies say "It is from Fracturing"

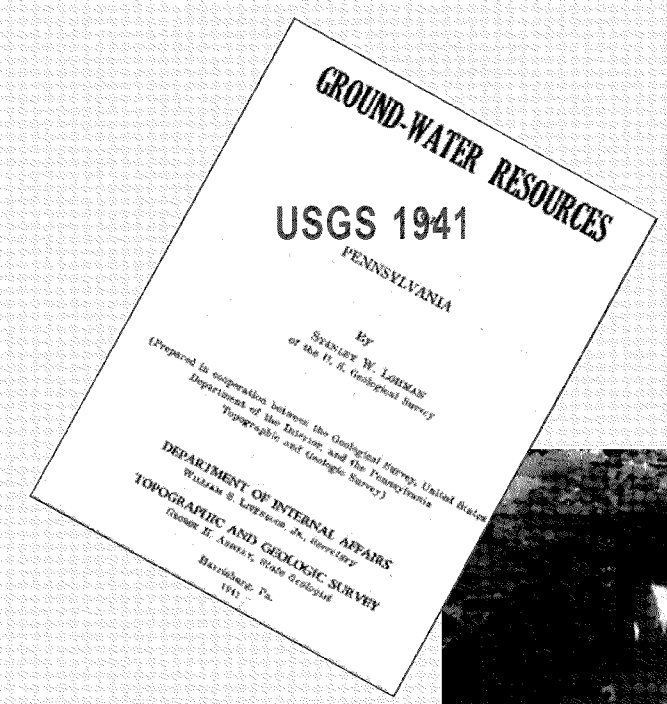




Reality: It is not that Simple!

Natural Gas Has Been Documented to be Present in Water Wells Pre-drill for Tens of Years

- **Extensive evidence of thermogenic gas reaching groundwater**
  - Historical surveys
  - Resident interviews
  - Oil and Gas Journal article
  - Exponent sampling of Northeastern PA


GROUND-WATER RESOURCES

USGS 1941

PENNSYLVANIA

By

STANLEY W. LOHMAN

(Prepared in cooperation between the Geological Survey, United States Department of the Interior, and the Pennsylvania Topographic and Geologic Survey)

DEPARTMENT OF INTERNAL AFFAIRS

TOPOGRAPHIC AND GEOLOGIC SURVEY

Harrisburg, Pa.

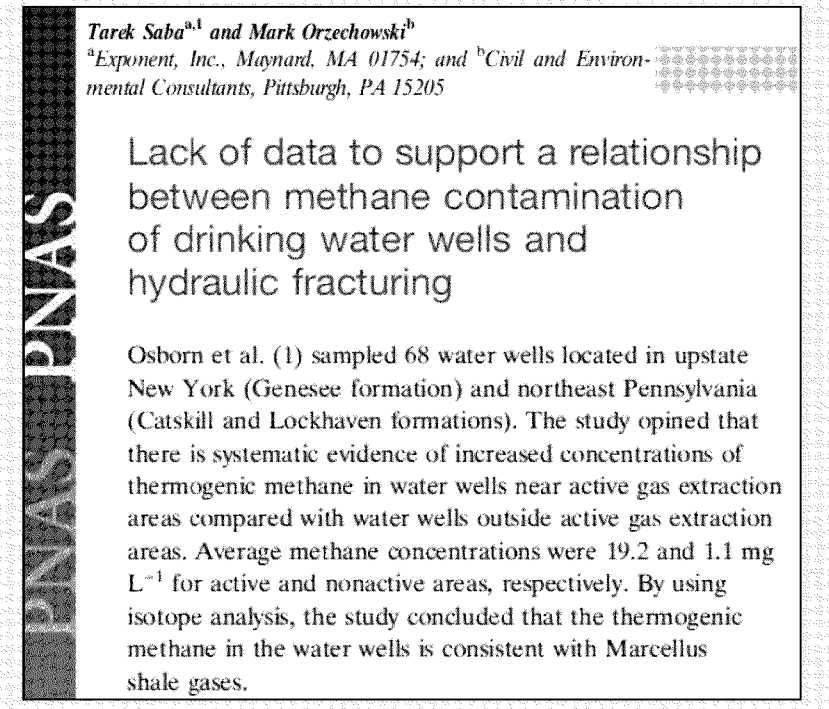
1941

Eternal flame, shale creek preserve, Chestnut Ridge Park, NY

Reality: The presence of thermogenic gas in water wells does not necessarily mean it is from hydraulic fracturing

What About Studies Confirming the Presence of Natural Gas in Water Wells from Hydraulic Fracturing?

- Duke University study—Reliable or speculative?



PNAS

Tarek Saba[a,1] *and Mark Orzechowski*[b]
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Lack of data to support a relationship between methane contamination of drinking water wells and hydraulic fracturing

Osborn et al. (1) sampled 68 water wells located in upstate New York (Genesee formation) and northeast Pennsylvania (Catskill and Lockhaven formations). The study opined that there is systematic evidence of increased concentrations of thermogenic methane in water wells near active gas extraction areas compared with water wells outside active gas extraction areas. Average methane concentrations were 19.2 and 1.1 mg L^{-1} for active and nonactive areas, respectively. By using isotope analysis, the study concluded that the thermogenic methane in the water wells is consistent with Marcellus shale gases.

You Decide

The Hunt for Chemicals Exceeding MCLs in Water Wells

- **Some chemicals in fracturing fluids and in flowback water are also naturally occurring**
  - Barium, iron, manganese, aluminum, etc…

Reality

- **Localized sources/activities contribute to chemicals in groundwater**
  - Fertilizer application (arsenic)
  - Leaky septic tanks (alkalinity)
  - Road runoff
  - Burn pits

Reality

The Central Question: What Is Your Baseline?

- **"We don't have baseline data" —What do we do?**
  - Baseline data from state and national surveys (e.g., schools, water suppliers, community centers, etc…)
  - Historical surveys (USGS bulletins)
  - Background soil sampling
- **Baseline exceedances of Secondary MCLs are common**

Myth: Chemical exceedances of MCLs could only result from fracturing activities

Chemicals Of Recent Interest

- **Glycols**
  - Famous from the Waxman Report

    Representatives Waxman, Markey, and Degette published a report on "Chemicals used in hydraulic fracturing" ("The Waxman Report").
  - Laboratory reliability issues (false positives) in the Pavilion Study
  - Recent analytical advances
  - Sources other than fracturing

Regulatory Trends

- **CERCLA : Methane and Petroleum Exclusion**
- **Diesel Ruling**
  - 2003: Memorandum of Agreement to eliminate use of diesel fuel in fracturing fluids
  - 2005—Congress exempted deep injection of fracking fluids (except for diesel) from SDWA
  - 2010: Without notice, the EPA posted regulations for fracturing activities involving diesel fuel under SDWA
  - 2012: ruling regarding diesel use in HF
- **2012 : EPA to publish Phase I of its comprehensive report.**

What Does Latest Studies Say About Environmental Impacts From Hydraulic Fracturing?

- **Duke study**
- **Pavillion Draft report**
- **Studies Concluding no Impact**
  - The University of Texas Study (February 2012)

    "None of the water well claims involve hydraulic fracturing fluid additives, and none of these constituents has been found by chemical testing of water wells" [http://energy.utexas.edu/]

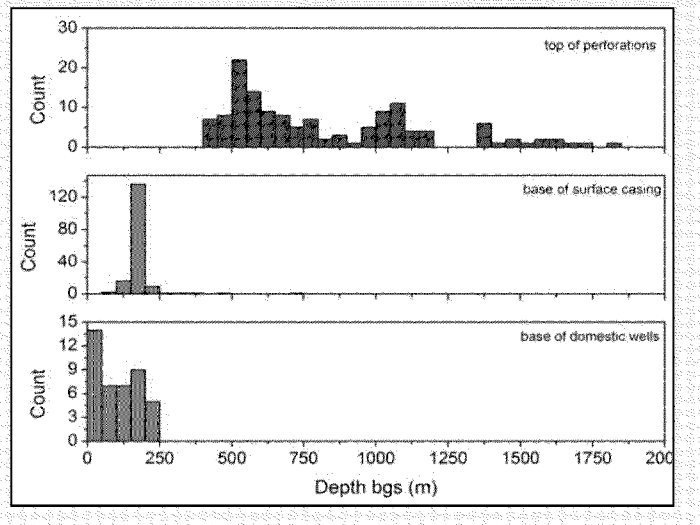
  - A Polish Government study (March 2, 2012)

    "Drilling at Poland's first shale gas exploration well using the controversial technique known as fracking has not harmed the environment, according to a government study published".

    [http://www.scientificamerican.com/article.cfm?id=polish-fracking-well-probe-shows-no]

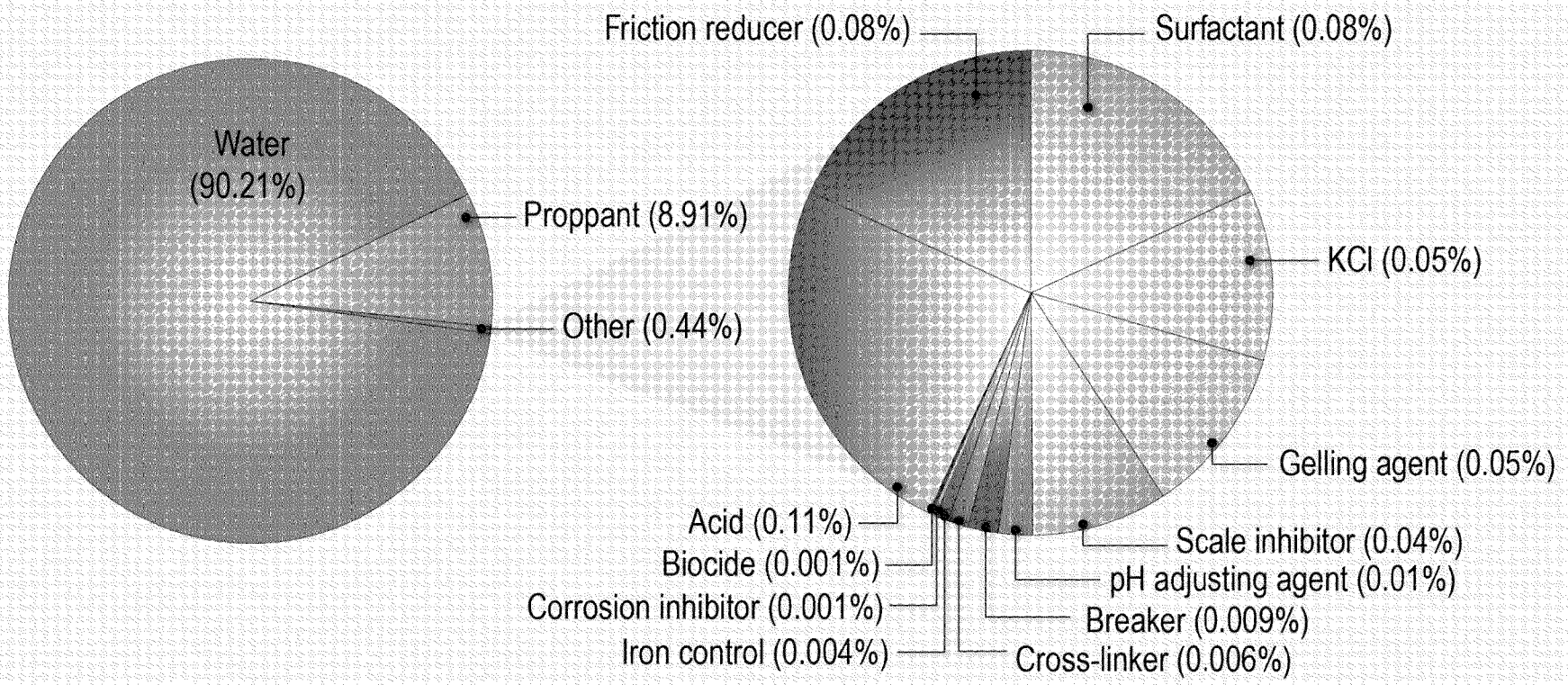
What Does Latest Studies Say About Environmental Impacts From Hydraulic Fracturing? *Cont'd*

- **EPA draft report concluding Impacts – Pavilion, WY**
  - Issues with laboratory analysis – e.g., glycols
  - Peer review of the draft report
  - Rebuttal by the industry posted on "Energy in Depth" website



http://www.epa.gov/region8/su perfund/wy/pavillion/Nov30-2011_W orkgroupPresentation.pdf

None of the Additives Have Primary MCLs

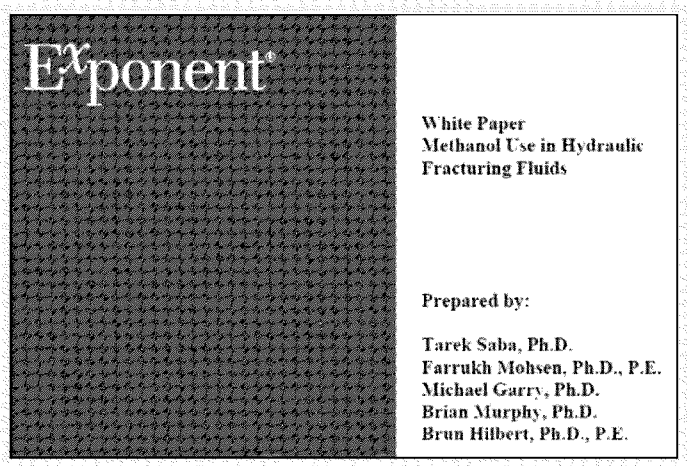


Source: Adapted from Authur et al. (2009)

www.fracfocus.com

Quantifying Impacts of Fracturing Additives

- **Exponent has developed a methodology of how to evaluate such impacts**
  - Methodology for estimating potential methanol impacts from use in fracturing:
    - Volumes used
    - Concentrations in water
    - Air emissions



Report available on the Methanol Institute's website.

Research Trends: Air Emissions

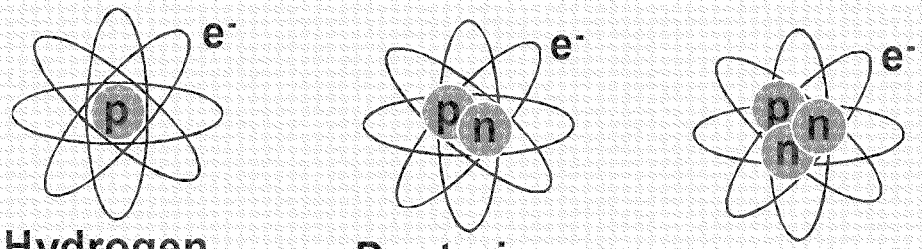
March 2012: Colorado School of Public Health: air emissions may pose a health risk (methane and benzene)

March 28, 2012: Due date for proposals to Canadian Petroleum Technology Alliance to study air effects.

Research Trends: Groundwater Age Dating

In cases such as Pavillion, WY, it may be possible to age date the groundwater extracted from drinking water wells.

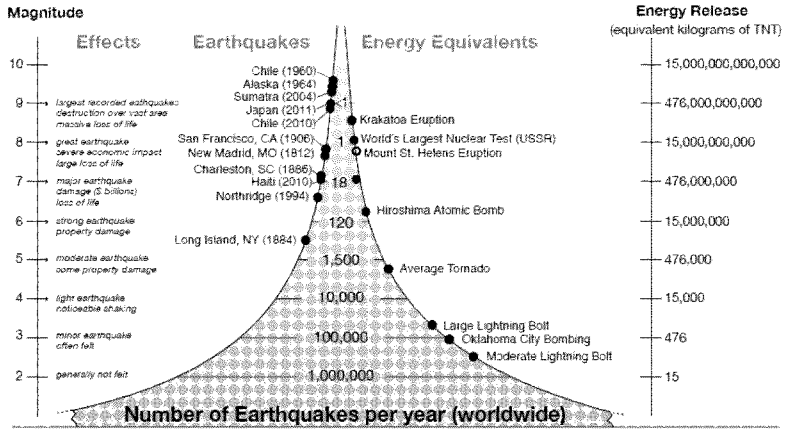
- **Concentrations of Tritium isotopes can give ball park estimate of groundwater**
- **Ratio of Helium-3 ($^3He_{tri}$) from the decay of Tritium, to Tritium can give reasonable estimates of age of groundwater (up to about 50 years)**



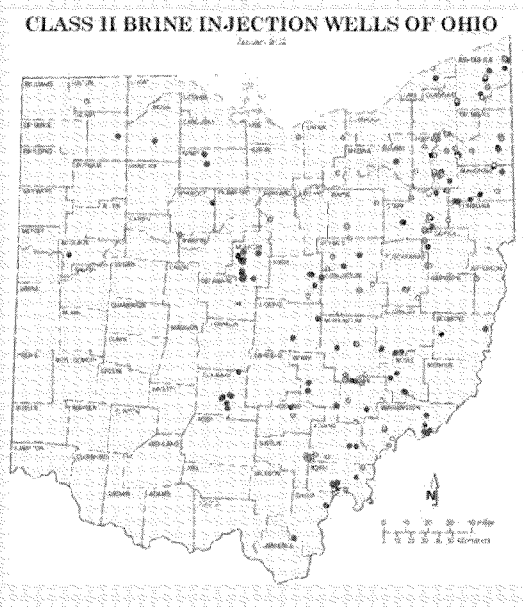
Hydrogen, ^1H | Deuterium, ^2H, D | Tritium, ^3H, T

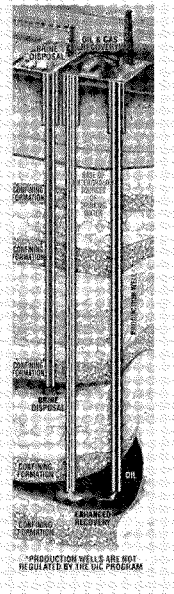
Fracturing, Deep Injection, and Earthquakes

- **Can fracturing cause earthquakes?**
  - Generally not felt, micro earthquakes (M ≤ 2)

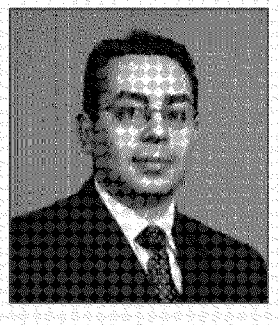


- **What happened in Youngstown, OH?**
  - Not from fracturing!
  - Deep disposal at Northstar 1
  - 1 of 177 deep wells in OH





Thank you



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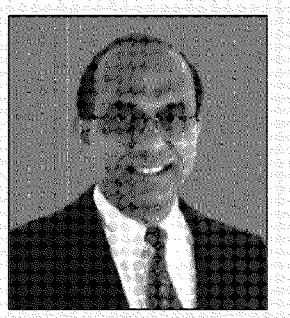

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We sincerely acknowledge all the help our colleagues Brun Hilbert and Betsy Mathiesen provided on earthquake issues.

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